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INVESTMENT BY WOMEN IN HIGHER EDUCATION: EXPECTED
RETURNS, INCREASING INVESTMENTS, AND IMPLICATIONS
FOR THE MALE-FEMALE EARNINGS DIFFERENTIAL

Marianne A. Ferber, Associate Professor of Economics,
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Summary

In this paper we explore the influence of women's expected earnings, together with other factors, on the extent of their investment in education and on their choice of fields, as well as some of the implications of these choices. The source of data on expectations is a nationwide survey of students conducted in 1976. Women are found to expect very high returns to education, particularly for advanced degrees and in male fields. These expectations help to explain recent high levels of investment in women's education and could help to explain their influx into male-dominated curricula, which in turn portend well for the closing of the male-female earnings gap in the future.

Investment by Women in Higher Education
Expected Returns, Increasing Investments, and
Implications for the Male-Female Earnings Differential

Marianne A. Ferber and Walter W. McMahon*

Women still receive only about one fifth of all professional and doctor's degrees, and a male-female earnings differential continues to persist. But the changing investment by women in higher education in recent years has been dramatic. The sources, direction, and extent of this investment have significant implications for the economy and for the role of women in society.

In this paper we explore for the first time the influence of women's expected earnings, together with other factors, on the extent of their investment and on changes in the fields being chosen, together with several of the implications. For example, the number of women completing bachelor's degrees is approximately equal to the number of men, and the percentage increases in the number of women completing advanced degrees is much higher than for men. The latter ranges up to a 268% increase since 1970 in the number of women completing professional degrees. These changes suggest higher rates of participation by women in the labor force, a potential continuation of lower fertility rates, and a potential narrowing of the male-female earnings differential. The fact that the rates of increase have been highest in those fields previously dominated by men also suggests further changes in the occupational fabric of society in the future. But there is potential for disillusionment as well, since one of the major findings reported in this study is that the earnings women expect at graduation and also twenty-five years after in male dominated fields are high not only in relation to women's earnings in the past, but also in relation to the earnings expected by men.

The literature on the earnings differentials between men and women by level of education includes studies by J. Mincer (1974, p. 122) who finds that the gap in 1959 was not as great for more highly educated women as it was for less educated ones. V. Fuchs (p. 238) further determined that between 1960 and 1970 the female-male earnings ratio (adjusted for hourly earnings) rose by 11.4% for employed women with some college education, but only 1.5% for those with less schooling. He projects a 47% increase in demand for well educated women and a 20% increase for the less well educated in the 1970's. W. McMahon (1977) finds that, perhaps as a result of these developments, women expect high earnings and high rates of return to education of up to 32%, accompanied by increases in enrollment of 26.7% for white women in bachelor's programs since 1972 and by a 45.7% increase in enrollment by black women. However, significant differentials in earnings of men and women continue to exist for the most highly educated women (Ferber and Kordick, 1977) as well as for women with less education (Ferber and Lowry, 1976). In this paper we propose to explore further the causes of the increased investment by women in education, the influence of expectations, and the implications of this for their earnings.

Data sources are given in Part I, while evidence on earnings expectations of male and female students, and the implicit expected rates of return are described and analyzed in Part II. In Part III, a broader set of influences on female investment decisions will be considered within the context of a two equation econometric model. Part IV will consider some of the implications, especially those for earnings growth and for the female-male earnings differential, and Part V will summarize the conclusions.

I. The Data

The principal sources for this study are micro-economic data from a nationwide survey of 2,580 students (and their families) who were freshmen in the Fall of 1972 and who could have completed bachelor's degrees in 1976, plus data on Earned Degrees Conferred from the U. S. National Center for Educational Statistics (1977) and on Earnings by Occupation and Education from the U. S. Bureau of the Census (1973). The survey was conducted by W. McMahon with the support of the National Institute of Education and the American College Testing Program. The response rate after two follow-ups was 73.6%. The sample results were re-weighted so as to conform with the distribution of all students in the U. S. by type of institution, sex, and percent receiving financial aid as described in McMahon (1977). The sample then was partitioned into four groups by sex (male/female) and race (black/white). The results reported in this paper focus primarily on the white females, with some comparisons to white males.

Two questions were asked in the survey about expected earnings:

- "1. What is the amount of annual income (before taxes) you expect to earn when you complete your formal schooling? \$_____ per year", with results reported in Table I, and
- "2. What is the amount of annual income (before taxes) you expect to earn 25 years from now? Provide your best estimate (assuming no inflation) even if you are uncertain. \$_____ per year", the results from which are reported in Table II below.

The results from these questions concerning earnings expectations (and also of high expected rates of return to be reported later) should be interpreted as in real terms with the effects of potential inflation removed.

Follow up questions were asked about the degree of uncertainty with which these expectations were held. But the degree of uncertainty did not turn out to be correlated with ability or with any of the other characteristics with which it was compared.

The expected earnings reported here should also be interpreted as applying to women who expect to enter the labor market upon graduation and remain employed. This is because "housewife" and "not employed" were both included in the list of occupations at graduation and later from which the respondents were asked to make a selection. Respondents selecting these options were screened out of all of the distributions reporting expected earnings and expected rates of return in Tables I-IV. As a further check, outliers were removed from the analysis, namely women expecting to earn less than \$5,000 or more than \$55,000 (with some variation in the limits depending on the planned degree level) upon completion of their education, or 25 years later. Those who declared an occupation but planned to work only a small part of the time are likely to have been eliminated by this second screen. Finally, if factors should arise later in life causing females to drop out of school or to drop out of the labor force, these are irrelevant to the decisions being made by these females now. It is these decisions about schooling with which we are concerned in this paper, and the expectations held at the time the decisions are made are the ones that are relevant.

II. Women's Expected Earnings

The rapid increases in enrollment by women at the more advanced levels and the shifts into fields which have smaller proportions of women can be explained in part by women's expected earnings.

Earnings Expected at Graduation. As can be seen in Table I, women expect to earn at least as much and often more than men. The average differential, weighted by the number of respondents in each cell, is \$645. This is consistent with the hypothesis that expected earnings that are not only high in relation to males but are also likely to be higher in relation to the past are contributing to the increased enrollment of females in college. Women expect to earn even more in relation to men at the more advanced degree levels. The mean difference between women and men at the Ph.D. level is \$3,934.

When the 34 occupations being chosen by respondents are sorted into those currently containing fewer men (<66%), middle range fields (67-89% men), and male dominated occupations (>90% men), it is interesting to notice that both men and women expect to earn more in those occupations that are predominantly male. The average difference between those occupations containing the most women (<66% men) and the male dominated occupations is \$4,695. But women are more optimistic about their prospective earnings in these male-dominated fields, particularly at the more advanced levels.

Earnings Expected 25 Years After Graduation. The results reported in Table II suggest that women now are expecting a more sustained participation in the labor force, with the growth of earnings that the

Table I. Earnings Expected at Graduation
By Sex, Degree Level, and by Percent of Men in the Field

	Assoc	BA	MA	PhD	Professional	Total
<u>Expected Earnings of Women</u>						
<u>Female-Intensive Fields</u> (Less than 66% men)	7,090 (N=30) (494.3)	8,666 (N=143) (207.7)	9,266 (N=104) (278.9)	9,722 (N=25) (530.2)	*	8,945 (N=307) (317.6)
<u>Mixed Fields</u> (66% to 89% men)	7,431 (N=10) (531.2)	10,805 (N=48) (436.1)	10,751 (N=25) (847.7)	12,452 (N=18) (1,241.2)	*	10,996 (N=104) (843.7)
<u>Male-Dominated Fields</u> (90% or more men)	8,689 (N=7) (1,461.3)	10,623 (N=33) (613.9)	12,490 (N=24) (822.5)	20,605 (N=9) (2,487.3)	23,629 (N=30) (2,396.7)	15,587 (N=103) (1,403.1)
Total	7,401 (N=47) (646.2)	9,413 (N=224) (316.5)	10,015 (N=153) (457.1)	12,551 (N=52) (1,115.0)	22,478 (N=38) (2,647.0)	10,692 (N=514) (641.6)
<u>Expected Earnings of Men</u>						
<u>Female-Intensive Fields</u> (Less than 66% men)	5,634 (N=69) (214.5)	8,630 (N=129) (203.0)	9,404 (N=129) (235.0)	8,750 (N=29) (632.2)	17,157 (N=6) (4,061.0)	8,486 (N=362) (314.9)
<u>Mixed Fields</u> (66% to 89% men)	*	10,525 (N=64) (381.4)	11,176 (N=43) (487.0)	12,809 (N=28) (1,098.6)	*	11,253 (N=151) (866.5)
<u>Male-Dominated Fields</u> (90% or more men)	9,852 (N=21) (766.5)	10,500 (N=46) (452.0)	11,219 (N=30) (626.5)	12,156 (N=6) (2,411.0)	14,517 (N=48) (861.5)	11,895 (N=151) (738.4)
Total	6,707 (N=94) (348.8)	9,497 (N=239) (298.7)	10,051 (N=202) (346.8)	10,878 (N=63) (1,008.9)	14,979 (N=56) (1,962.3)	9,870 (N=654) (531.6)

(The standard error is shown in parentheses below each mean, calculated as $\sqrt{\text{variance}/(n-1)}$, with the numbers in each cell as shown.)

*N<5.

accumulated experience provides. To the extent that women expect to drop out of the labor force when they have young children, their expected earnings should increase less than those of men. However, surprisingly little of this effect is evident. The difference in mean expected earnings now favors men but only by a very small \$29. And expected earnings of women at the Ph.D. or equivalent level are higher by \$3,176 than for men.

The latter is consistent with the higher sustained labor force participation rates of female Ph.D.'s. Ferber and Kordick (1978) have found in a recent nationwide study of women Ph.D.'s that about 94% were working, and that those in the labor market had worked approximately 92% of the time since graduation on a full time equivalent basis. There is not the same degree of sustained participation in the labor force among women with less education.

Is it realistic for women to expect to earn as much as men in those fields requiring bachelor's, masters, professional, and Ph.D. degrees, even when they do work continuously? While not much research is available that has controlled for differences in accumulated experience, there are studies of at least one particular sector, namely university faculties, that have done so. All of these studies have found that women are paid less than men.¹ Thus one must conclude that women in this survey are extremely optimistic, but that there are trends that give grounds for some optimism. Thus, for instance, Fuchs (1974), after a detailed examination of recent trends of female labor force participation and earnings, concludes that "during a period of rapid increase in supply, female (hourly) earnings were more than able to

Table II. Earnings Expected 25 Years After Graduation
By Sex, Degree Level, and by Percent of Men in the Field

	Assoc	BA	MA	PhD	Professional	Total
	<u>Women</u>					
<u>Female-Intensive Fields</u> (Less than 66% men)	12,641 (N=30) (1187.3)	14,800 (N=143) (499.3)	16,255 (N=104) (784.6)	18,311 (N=25) (1177.7)	*	15,817 (N=307) (883.4)
<u>Mixed Fields</u> (66 to 89% men)	12,380 (N=10) (995.5)	20,668 (N=48) (944.8)	21,949 (N=25) (1897.7)	23,076 (N=18) (2599.8)	*	20,861 (N=104) (1589.9)
<u>Male-Dominated Fields</u> (90% or more men)	12,222 (N=7) (498.8)	19,765 (N=33) (967.4)	21,266 (N=24) (1337.3)	25,998 (N=9) (4259.9)	46,274 (N=30) (4527.4)	27,868 (N=103) (2346.3)
<u>Total</u>	12,523 (N=47) (1043.9)	16,789 (N=224) (663.7)	17,971 (N=153) (1053.2)	21,291 (N=52) (2203.4)	44,471 (N=38) (5388.4)	19,253 (N=514) (1319.5)
	<u>Men</u>					
<u>Female-Intensive Fields</u> (Less than 66% men)	9,431 (N=69) (503.9)	14,872 (N=129) (458.5)	17,198 (N=129) (618.9)	17,959 (N=29) (1654.9)	32,359 (N=6) (8254.1)	15,201 (N=362) (749.4)
<u>Mixed Fields</u> (66% to 89% men)	*	21,211 (N=64) (1011.6)	23,558 (N=43) (1460.7)	33,253 (N=28) (4520.9)	*	24,472 (N=141) (2398.2)
<u>Male-Dominated Fields</u> (90% or more men)	19,301 (N=21) (2121.2)	20,109 (N=96) (1059.6)	24,645 (N=30) (1245.0)	31,430* (N=6) (5856.5)	31,773 (N=48) (1533.2)	25,055 (N=151) (1585.2)
<u>Total</u>	11,842 (N=94) (894.1)	17,577 (N=239) (722.3)	19,658 (N=202) (891.1)	26,039 (N=63) (3328.8)	32,341 (N=56) (3614.3)	19,475 (N=654) (1297.8)

(The standard error is shown in parentheses below each mean, calculated as variance/(n-1), together with the n for each cell as shown.)

*N<5

hold their own and for some groups show significant gains, so the long-run prospects for women must be viewed as favorable." Also Lazear found that young women experienced significantly higher rate of wage growth in 1974 than in 1968, which he ascribes to higher investment in on-the-job training.

Even assuming that young women are not altogether unrealistic in anticipating rates of labor force participation and earnings equal to that of men, it is not easy to see why they would actually anticipate higher earnings at the time of their graduation than those expected by young men. Before examining this question further, however, it will be useful to compare both the level of expected earnings by men and women with mean actual earnings for men, and the pattern of expected earnings by occupation with the existing occupational pattern of earnings for men.

Expected vs. Actual Earnings. Expected earnings can be compared to mean actual earnings as reported by U. S. Bureau of the Census (1973) for those occupations for which data are available from both sources. When this is done, we find that real earnings expected by white males, adjusted for age and level of education are almost twice as high on the average as the actual earnings shown by the Census: \$9,871 as compared to \$5,487. To the extent that money earnings increased in the five years or so between the time the Census data were collected and the time for which respondents gave their estimate of earnings expected at graduation, some of this increase (about 26% for those planning to be in school for four years) is accounted for. But since explicit instructions were given to the respondents to assume no further inflation when giving their estimate, the earnings expec-

tations of males are still high. The even higher expectations of women, of \$10,516 at graduation, seem therefore all the more surprising.

But what is the pattern of expected future earnings differentials among occupations? To determine this, actual earnings for each occupation were adjusted according to the amount by which mean expected earnings exceeded mean actual earnings, 2.01 for men and 2.09 for women. This reveals that women tend to expect higher earnings than men at higher levels of education, and particularly in more male occupations. Of the 31 cells for Associate and B.A. degrees by occupation, women's expected earnings were higher than men's in half the cases (15), but of the 38 cells of M.A., Ph.D. and higher professional degrees women's expected earnings were higher in 24 cases. Of the 22 cells in occupations where men constitute two-thirds or less of the labor force women expected to earn more than men in only 6 cases, but of 57 cells in more male occupations, containing 90% or more men, women's expectations exceed men's in 33 cases! There may be a tendency, particularly on the part of women, to overestimate the rewards in occupations from which they have historically been excluded.

Overall, we must conclude that women appear to have expectations for earnings which appear high even on optimistic assumptions about their labor force participation and equal opportunities in the labor market, but nevertheless (as will be developed) motivate an increasingly large number of women to enter these human capital intensive male dominated fields. To the extent that these expectations cause them to obtain more education and move into traditionally male occupations, they

will succeed in increasing their earnings and help narrow wide present gap in male and female earnings. While estimates vary on the fraction of the present 40% earnings gap that should be attributed to differences in occupational distribution, most conclude that it is a substantial portion.²

Polachek (1977) concludes that women's intermittent labor force participation was also one of the important factors keeping women out of occupations where learning on the job is highly rewarded, but interruptions severely penalized. Hence women crowded into occupations, mainly clerical and service, where earnings are relatively low, but reentry is easy. He estimates that with "full lifetime labor force attachment...human capital considerations would dictate a 35% increase in the number of women professionals [and] a more than doubling of the number of women in managerial professions..." This line of reasoning points toward a positive association of labor force participation and the shift of women toward the more human capital intensive "male" occupations.

Expected Rates of Return. So far our analysis has been concerned only with expected earnings, ignoring the cost of acquiring the necessary education. This is unreasonable if the entire family decision making process is considered, as it must be. To the extent that students are supported by their families and/or outside agencies, the costs are not theirs, except insofar as they live more frugally than they would if they had a job. Under these conditions the student taken alone would be mainly concerned with future earnings. But to the extent that the family who supports the student plays an important part in influencing the type and

level of education, the focus should be on the expected rate of return to investment, which does reflect costs.

Table III shows expected annual rates of return for women and men students by occupation, based on information provided by the students about net tuition, fees, and book costs incurred by them and their families, the foregone earnings costs of attending college (as measured by the income earned by persons of the same sex, race and age as the respondent as reported in the 1970 Census), and on the expected net addition to their earnings.³ It is instructive to examine the similarities and differences between the results shown here and those on earnings examined previously.

First, expected rates of return for women exceed those for men even more consistently than do expected earnings. This can be explained by the fact that the opportunity cost of the student is calculated on the basis of actual earnings of women at the time of the 1970 Census, which were somewhat lower than those for men.

As for earnings at different levels of education, however, the picture is quite different than for expected earnings. In all instances but one (the professional degree level in male occupations), women's (and men's) expected rate of return declines. Here again we must look for an answer on the cost side. In particular, foregone earnings costs are higher at the more advanced levels.

Lastly, rates of return, as well as earnings are higher for the more male occupations. While the pattern is not clear as between those occupations with 67% to 89% men and those with 90% or more men, all

Table III. Expected Rates of Return by Sex,
Degree Level, and by Percent of Men in the Field

	Assoc	BA	MA	PhD	Professional	Total
<u>Women</u>						
<u>Female-Intensive Fields</u>	0.463	0.328	0.267	0.172	*	0.311
(Less than 66% men)	(30)	(143)	(104)	(25)		(307)
	0.290	0.193	0.203	0.106		0.200
<u>Mixed Fields</u>	0.598	0.438	0.354	0.217	*	0.394
(66 to 89% men)	(10)	(48)	(25)	(18)		(104)
	0.239	0.202	0.188	0.150		0.193
<u>Male-Dominated Fields</u>	0.483	0.466	0.414	0.338	0.491	0.451
(90% or more men)	(7)	(33)	(24)	(9)	(30)	(103)
	(0.279)	0.230	0.236	0.246	0.241	0.239
Total	0.495	0.372	0.304	0.216	0.481	355
	(47)	(224)	(153)	(52)	(38)	(514)
	0.278	0.200	0.206	0.145	0.239	206
<u>Men</u>						
<u>Female-Intensive Fields</u>	-0.028	0.090	0.092	0.135	0.177	0.073
(Less than 66% men)	(69)	(129)	(129)	(29)	(6)	(362)
	(0.196)	(0.201)	(0.193)	(0.271)	0.159	(0.202)
<u>Mixed Fields</u>	*	0.227	0.257	0.190	*	0.236
(66 to 89% men)		(64)	(43)	(28)		(141)
		(0.134)	(0.224)	(0.235)		(0.189)
<u>Male-Dominated Fields</u>	0.441	0.223	0.242	0.118	0.247	0.264
(90% or more men)	(21)	(46)	(30)	(6)	(48)	(151)
	(0.345)	(0.221)	(0.147)	(0.014)	(0.179)	(0.206)
Total	0.096	0.152	0.149	0.166	0.244	0.152
	(94)	(239)	(202)	(63)	(56)	(654)
	(0.232)	(0.187)	(0.193)	(0.240)	(0.186)	(0.200)

(The standard error is shown in parentheses below each mean, calculated as $\sqrt{\text{variance}/(n-1)}$ with the numbers in each cell as shown.)

*N<5

educational levels for both men and women show lower expected mean rates of return in the female-intensive occupations.

III. Other Influences on the Amount Invested by Women in Higher Education

To explain why women are planning to invest more in higher education through choice of the more advanced degree programs typical of male dominated fields, it is necessary to isolate additional influences on their decisions to invest.

To do this an investment-theoretic framework is appropriate, where planned investment expenditure and the expected rate of return are the jointly dependent variables. A two equation model therefore was specified containing an investment demand function and a supply-of-funds function, with appropriate variables to control for the shifts in each. This model then was estimated by simultaneous equation three stage least squares methods for the total investment planned by women in postsecondary education. Then the same model was re-estimated focusing on the financial contribution made by the parents of these same women.

The Model

The investment demand, or marginal efficiency of investment function and the supply of resources function are both illustrated in Figure 1 and shown in Equations (1) and (2) below respectively. Total investment by the family, I_F , and the expected rate of return, r , are treated as jointly dependent here and in the actual process of estimation. The positions of the jointly dependent variables are reversed from what might be expected in Eq. (2) in order to minimize the impact of measurement errors.

Investment by the family, I_F , is defined as the sum of tuition and fees (net of scholarship aid), expenditure on books, and foregone earnings multiplied by the number of years required to complete the degree program planned by the female student. The expected rate of return, r , is the rate of return expected per dollar invested. This and the cost per dollar of the resources used are both measured on the vertical axis in Figure 1.

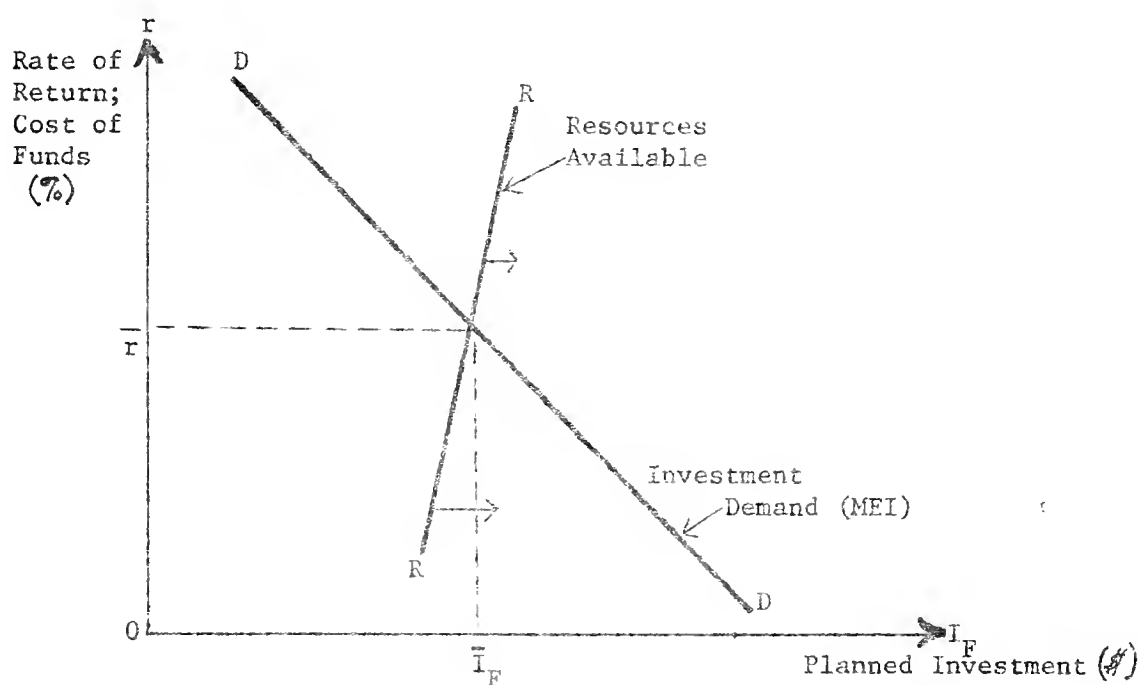


Figure 1. Woman's Investment-Demand (DD) in Relation to Available Resources (RR)

The investment demand function is expected to slope downward (i.e., α_1 , to be negative) because as females plan longer degree programs (e.g. I_F larger), additional tuition cost and additional foregone earnings costs cause expected rates of return to be lower, even though expected earnings are higher.

The complete model is:

(1) Demand: $I_F = \alpha_1 r_D + \alpha_2 \mu + \alpha_3 A + \alpha_4 S_P + u_1$

(2) Supply: $I_F = \beta_1 r_S + \beta_2 L + \beta_3 Y + \beta_4 W + \beta_5 N + \beta_6 S + u_2$

(3) Equilibrium: $r_D = r_S$

where:

- I_F = investment by the family, (including I_P , investment by the parents),
- r = expected annual rate of return (or cost),
- μ = her degree of uncertainty about future earnings, e.g. very certain, reasonably certain, somewhat uncertain, very uncertain.
- A = ability or achievement, measured by ACT Comprehensive score,
- S_P = stock of family tastes for college, as indexed by father's college attendance (=1) or non attendance (=0),
- L = loans to student,
- Y = disposable income of the family, including student earnings,
- W = work by the student (replacing hours of study or leisure),
- N = number of siblings in the family,
- S = scholarships, summing those received from the college, the state, BEOG's, and all others, and
- u_1, u_2 = disturbances.

Considering briefly these determinants of demand, it should be kept in mind that the model is to be estimated for white females only. The effect of the higher rates of return expected by females on increased investment discussed in section II above (as well as the effect of racial differences), has already been taken into account by the partitioning of the sample, and the model focuses on the causes of differences among white females in the amount they and their families plan to invest. It should

also be kept in mind that those females planning to become housewives or for other reasons not to enter the labor force have been eliminated from the data.

There are differences however among the remaining females in the degree of uncertainty with which they hold their expectations (μ), their ability (A), and the tastes for further education (S_p) which are likely to be influenced in part at younger ages by the parents. It is necessary to control for these differences among females, in order to remove these sources of shifts in the investment demand function as among families, and thereby leave a single stable investment demand function of the type illustrated in Figure 1.

Similarly, there are differences among female students in the supply of resources and of time available to invest in further education. These differences cause shifts in the supply function. Some, such as scholarships, through their effect on investment costs, affect the computation of the rate of return on the demand side, as well as the supply-price and availability of funds. To be conceptually correct, they must enter the computation of both the demand and the supply function. The differences in resources available to individual women students are due to subsidized student loans, L , differences in family disposable income Y , differences in the amount of time withdrawn, W , from studies (and from leisure) for part-time work the number of siblings that compete with the student within the family for available resources, N , and scholarship aid, S .

Empirical Results

The estimates obtained for this model, applied first to the total amount

of investment that these females plan to make in higher education, I_F , and then to the parental contribution (I_P), are shown in Table 4.

Table 4. Determinants of Differences in the Amount of Investment in Education Planned by Women*

(t-statistics are shown below each regression coefficient in parentheses. Coefficients significant at least at the .05 level are underlined.)**

<u>Total Investment</u>	
(4) Demand:	$I_F = \frac{-9.12r}{(2.14)} - \frac{4.29u}{(2.19)} - \frac{.04A}{(.45)} + \frac{1.96S}{(1.97)^P} + \frac{19.13}{(6.72)}$
(5) Supply:	$I_F = \frac{.73r}{(2.35)} + \frac{.33L}{(17.40)} + \frac{.02Y}{(2.87)} - \frac{.52W}{(24.31)} - \frac{.56N}{(16.30)} + \frac{.001S}{(6.73)} + \frac{14.32}{(96.49)}$
<u>Parental Contribution</u>	
(6) Demand:	$I_P = -\frac{4.00r}{(1.98)} - \frac{.44u}{(.46)} + \frac{.14A}{(3.35)} + \frac{.85S}{(1.99)^P} + \frac{2.31}{(1.67)}$
(7) Supply:	$I_P = -\frac{.01r}{(.07)} - \frac{.02L}{(24.42)} + \frac{.03Y}{(7.65)} - \frac{.18W}{(16.40)} - \frac{.20N}{(11.06)} - \frac{.0001S}{(.11)} + \frac{.48}{(62.38)}$

*n=492 white female respondents, 6 months after graduation from high school. All took the ACT test, and most but not all went on to college. For items in the questionnaire filled out by students see McMahon (1974), pp. 172-5; and for the financial information reported by parents see pp. 176-9.

**These three stage least squares estimates are more efficient than the two stage least squares estimates, although the latter are very close to the coefficients shown. As a measure of goodness of fit, the standard error of the estimate divided by the mean of the (jointly) dependent variable in Eqs. (4) through (7) is .68, .13, .52, and .12 respectively, indicating that most of the explanatory power lies in the supply of resources.

Interpretation of the Results

The decline in the rate of return at the more advanced degree levels revealed by the negative slope of the demand function given by the significant

negative coefficient for r in Eq. (4) does curtail indefinite expansion of investment as anticipated. Several types of potential non-monetary returns to be expected from higher education were tried in this demand function,⁴ but somewhat surprisingly did not produce interesting or significant results so they were deleted. The degree of uncertainty expressed about future earnings, μ , inhibits planned investment by females in Eq. (4) as would be expected. Family tastes as reflected through the father's attendance at college, S_p , increases planned investment in Eq. (4), as well as the amount contributed by parents in Eq. (6). Ability, A , has the wrong sign in the total investment demand function (4) but is not significant in determining total demand, although it does affect investment indirectly by increasing the parents willingness to assist in Eq. (6), and is likely to also increase scholarship aid, S , in Eq. (5).

Some factors which help to determine the amount invested are included in the supply equations (5) and (7). Results in both cases show that the supply of funds is most emphatically not perfectly elastic as would be the case if females entered purely competitive money markets to secure loans to finance their education. The reason is that human capital cannot be mortgaged as collateral and is a poor credit risk for private bankers. Therefore investment in human capital tends to be financed largely out of parents' current income. Guaranteed student loans, L , however are a significant determinant of investment by women in Eq. (5), although they significantly reduce the parents contribution as seen in Eq. (7). Parental income, Y , increases investment by women, (and has a strong positive effect for all other population segments) by increasing the amount of help contributed

by parents as may be seen in Eq. (7). Scholarship aid, S , is positively associated with increased investment in Eq. (5) although it decreases the parental contribution in Equation (7). Part time or full time work, W , significantly reduces the amount of time invested in study in Eq. (5), as well as being negatively related to the amount contributed by parents in Eq. (7) as would be expected. Finally, the number of brothers and sisters to be supported by the family, N , significantly curtails the resources available, and hence the plans of females to further their education, also as expected.

In summary, in addition to the expected rate of return and such influences as the parents' education which affect women's demands for more advanced training in specific ways, the availability of resources to finance the time that must be used to acquire further education emerges as a very important set of determinants. In the future as the education of parents and parental income grows, and should guaranteed student load funds and Federal and state scholarship support continue to grow, the numbers of women attending college and the number seeking advanced degrees can be expected to continue to increase.

IV. Implications of Increased Investment

As noted earlier, women to date still experience significantly lower earnings than men, associated with a concentration in "female" fields, less penetration of those fields requiring advanced education, and a lower labor force participation rate. We turn finally to some of the implications of the high expectations, increased investment, and changing patterns of

investment of women for their future earnings and for the female-male earnings differential.

To do this it is necessary to consider 1) the direct effect of more education, 2) the effect of shifts toward male fields, 3) the indirect effects through increased labor force participation, and 4) the potential indirect effects through lowered fertility rates.

Direct Effects of Additional Education on Earnings

To estimate the potential effect of the increasing investment in education in the absence of shifts toward a different occupational pattern, we obtained the weighted mean of the earnings of women within each occupation by their level of education. We used data for those women employed 50-52 weeks per year to avoid confounding the direct effect on earnings with the effect of education on increased labor force participation. We were not able to remove the effect of increased education on the number of hours worked, however. With no shifts among occupations and no increase in the number of weeks worked, the effect of one additional year of education raised earnings by 3.3 percent per year.

The 3.3% increase in earnings is relatively small, only \$14-16,000 over an entire working lifetime for the average two-year Community College graduate however. This is in large part because additional education is not highly rewarded in many of the occupations which at present have a high concentration of women. For instance, secretaries with 4 years of college earn only 8.9 percent more than those with a grade school education. The difference for cashiers is 13.0 percent; for operatives, 10.7 percent. Low rates of return are reported in similar fields in McMahon (1977).

Direct Effects of Education Including Occupational Shifts

A more realistic idea of the value of more years of schooling, which takes into account the fact that more highly educated women are likely to shift into different occupations, is obtained from the mean earnings of women at different levels of education. The mean increase for women employed 37-51 weeks a year then is 1.3 percent, a sizable 5.1 percent increment over the increases attainable without shifts in occupation. The monetary value of further schooling measured in this manner is considerably higher than the first estimate, now a \$58-1,000 increment to lifetime income for each additional year of schooling. It would be still larger except for the fact that predominately female occupations which require more schooling are not particularly well paid. For instance, nurses with 4 years of college earn, on the average, only \$7619; teachers, \$7651. Librarians with 3 or more years of college earn \$9001, social workers \$8851.

It is also relevant to compare the level of education of men and women within each major occupational category, as shown in Table 3.

Table 5. Mean Education of Men and Women 16 Years and Older by Occupation*

Occupation	Mean Years of Education	
	Men	Women
Professional, technical and kindred workers	15.5	14.9
Managers & administrators, exc. farm	13.0	12.3
Sales workers	12.6	11.4
Clerical and kindred workers	12.1	12.1
Craftsmen & kindred workers	10.6	10.7
Operatives & kindred workers, exc. transport equipment oper.	10.1	9.8
Transportation equipment operatives	10.1	10.8
Laborers	9.6	10.1
Farm workers	9.4	9.3
Service workers	10.3	10.1
*Source: U. S. Department of Commerce, Bureau of the Census, 1970 Census, Occupation by Industry		

Men are more highly educated in six categories, women in three and both are equal in one category. The most interesting fact that emerges from these data, however, is that women are relatively highly educated in occupations where additional schooling is not highly rewarded, and vice versa for men. This is shown in Table 6.

Table 6. Difference Between Mean Years of Schooling of Men and Women and the Earnings Differential Between Poorly and Highly Educated by Occupation*

Occupation	Excess of mean number of years of schooling of women over men	Index of earnings of men with some graduate work (Earnings of men with grade school education = 100)
Sales workers	-1.2	186.2
Managers & administrators, exc. farm	-0.7	183.2
Professional, technical & kindred workers	-0.6	181.8
Operatives & kindred workers, exc. transportation equipment oper.	-0.3	142.0
Service workers	-0.2	187.2
Farm workers	-0.1	167.8
Clerical & kindred workers	0.0	162.9
Craftsmen & kindred workers	+0.1	166.4
Laborers	+0.5	135.3
Transportation equipment workers	+0.7	127.7

*Based on data in U. S. Department of Commerce, Bureau of the Census, 1970 Census, Earnings by Occupation and Education, Occupation by Industry

If women are to reap greater rewards for the additional schooling they are getting they must shift not merely to different 'female' occupations, but move into occupations that have been traditionally male. A previous study by Ferber and Lowry (1976) based on 1970 Census data found that if women had been so distributed among the 12 major occupational categories as to duplicate the male patterns, their earnings would have increased 12 percent, without any change of relative earnings within occupations or any increase in their level of schooling. Of course such a major shift between occupations would not leave the earnings in the various occupations unaffected. So the gains would be greater to the extent that salaries

in women's occupations would go up, but lower to the extent that in previously predominantly male occupations, earnings would decline. In any case, however, it is reasonable to expect a rather substantial increase in women's earnings if they both obtain more education and make a substantial adjustment in their occupational structure.

Indirect Effects of Education on Earnings via Higher Participation Rates

In the previous calculations we have accepted women's earnings as given for each educational level and each occupation, and have recognized that this level is substantially lower than men's earnings. While there is considerable disagreement about the precise contribution various factors make to this differential, there is general agreement with the point developed by Mincer (1974) that differences in learning by experience are important. The estimate in the 1974 Economic Report of the President (p. 155) that women's earnings are at least 17 percent lower than men's because of this one factor is representative. A strong positive relation between schooling and labor force participation has developed since 1950. In that year 20.2 per cent of women with one to four years elementary education, 32.3 per cent of high school graduates and 47.1 per cent of those with five or more years of college were in the labor force. By 1970 the respective figures were 33.7, 49.8 and 70.1 per cent.⁵ It is plausible, on this evidence to predict a greater increase in women's earnings as a result of the increased labor force participation rates brought about by more years of schooling.

Indirect Effects of Education on Earnings via Fertility Rates

A final factor clearly related to the higher labor force participation of more highly educated women is the negative relation between

education and fertility. While women with one to four years of elementary school average 3.59 children, the numbers are 2.22 for high school graduates, 2.05 for college graduates and 1.53 for those with five or more years of college. These data alone provide no evidence of the direction of causation among these related phenomena. However, since most education is acquired before a woman enters the labor market or has children, it is not unreasonable to suppose that increased education increases the value of women's time, encouraging substitution away from time intensive activities such as child rearing, and facilitating entry into the labor market as has been suggested by T. W. Schultz (1973). Yet the arrival of a child may sometimes interrupt schooling.

It is more problematic to establish cause and effect when it comes to fertility and labor force participation. Prior to the new economic theories of fertility⁶ it was assumed that it is the number of children that influences whether the mother will work, rather than vice versa. Furthermore, it has generally been assumed that while the father is likely to work more when he has more children to support, the mother will be less likely to work because she has greater "household responsibilities".

All of these assumptions are being questioned today. With the increasing knowledge and acceptance of birth control the arrival of children no longer needs to be a 'given,' and there is increasing evidence that work plans influence family planning more than vice versa.⁷ With the rapidly increasing number of female headed households it is also likely that the need for additional income gives these women additional reason to enter the labor market. Meanwhile, however, it is clear that the relationship

between lower fertility and higher labor force participation dominates for married women, who still constitute a substantial majority of the female population of working age. Therefore it is entirely plausible to conjecture that more education, itself indicative of growing career orientation, and resulting in more attractive as well as more remunerative job opportunities, will be associated with a permanently lower birthrate.

V. Conclusions

Along with the direct and indirect effects of further education on earnings, labor force participation, and fertility rates, there is also increasing evidence of changes in societal attitudes which inevitably influence the individual's decisions. Woman's role beyond the confines of her family appears to be increasingly accepted not only by feminists, but also by men and women who disavow interest in or support for the feminist movement. A further indication of the change in attitudes is a recent survey of female high school seniors which showed that only 21 percent believed 'woman's place is in the home' and that an astoundingly low 3 percent preferred 'housewife' as their career.⁸

We conclude that the new findings we report concerning women's expectations of high earnings, and high expected rates of return, from advanced education are related to the amount of planned investment and to the choice of field. This stimulus to investment is augmented by the effects of family income and government financial aids to students so that these high earnings expectations may not be totally unrealistic. For one thing, the increasing investment by women in higher education

has implications for increased labor force participation rates, which Kreps (1976) suggests may before long approach those of men, and for lower fertility rates, both of which in turn increase earnings. There is in addition the direct effects of increased investment in education on earnings in the low-paying fields and on increasing choice by women of higher paying professional fields. Thus earnings of women may be expected to increase significantly, and the differential between male and female earnings to decrease over time.

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Footnotes

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¹See for instance, Astin and Bayer (1973), Loeb and Ferber (1973), and Gordon, Morton and Braden (1974).

²See for instance, Sanborn (1964) and Fuchs (1971).

³The methods of computing the expected rates of return for each student are developed further in McMahon, Hoang, and Wagner (1977).

⁴To appraise the relative importance of several kinds of expected non-monetary returns, students were asked to rate on a scale of one to five the degree of importance they attributed to using their college education in later life to guide their children, to provide continuing access to new ideas through reading, to meet interesting people, to enjoy non-monetary job satisfactions, to find a spouse with compatible college values, and to locate a suitable career. The resulting indices were tried in the regression equations.

⁵The unemployment rate in 1970 also varied from 6.7 per cent for those with one to four years of elementary school to 3.7 for high school graduates and 1.7 per cent for women with five or more years of college.

⁶See Waite and Stolzenberg (1976), as well as the new home economics literature alluded to in T. W. Schultz (1973).

⁷See Waite and Stolzenberg (1976).

⁸Based on the National Assessment of Educational Progress survey.

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